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(54) **SYSTEMS AND METHODS OF MANAGING NETWORK COMMUNICATION**

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H04L 12/801 (2013.01)

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CPC ***H04L 12/569*** (2013.01); ***H04L 47/10*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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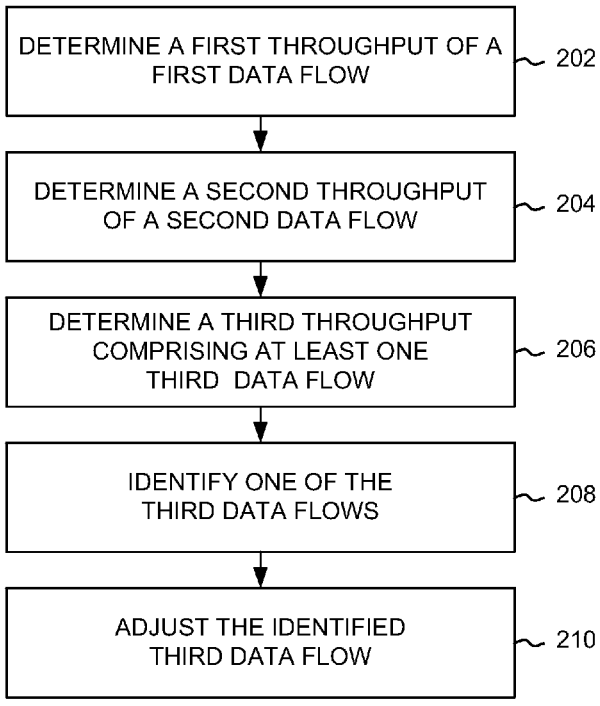
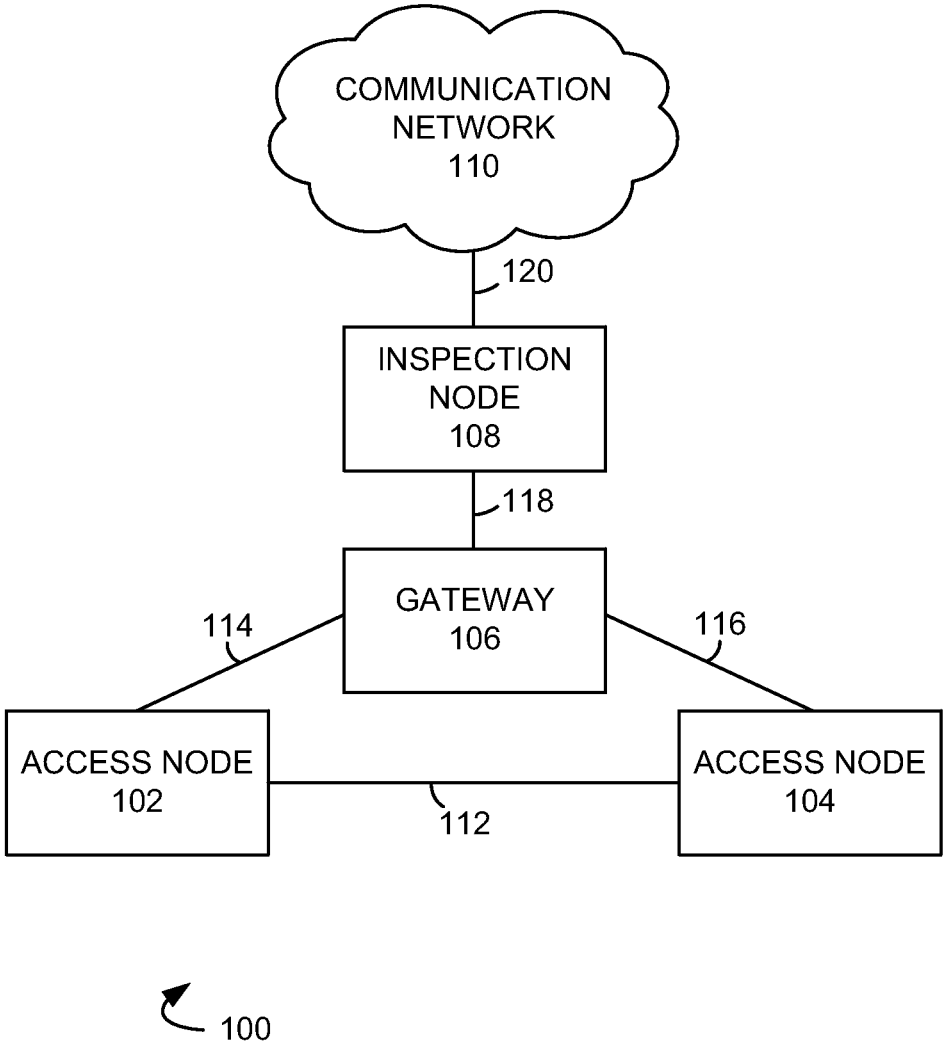
(57) **ABSTRACT**

A first throughput is determined of a first data flow at a gateway from a first access node and a second throughput is determined of second data flow at an inspection node from the gateway. A third throughput is determined comprising one or more third data flows from the gateway to a second access node based on a difference between the first throughput and the second throughput. At least one of the third data flows of the third throughput is identified, and when the third throughput meets a throughput threshold the identified third data flow is adjusted.

13 Claims, 5 Drawing Sheets




COMMUNICATION NETWORK 110
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INSPECTION NODE 108
118
GATEWAY 106
114
116
ACCESS NODE 102
112
ACCESS NODE 104
100

FIG. 1

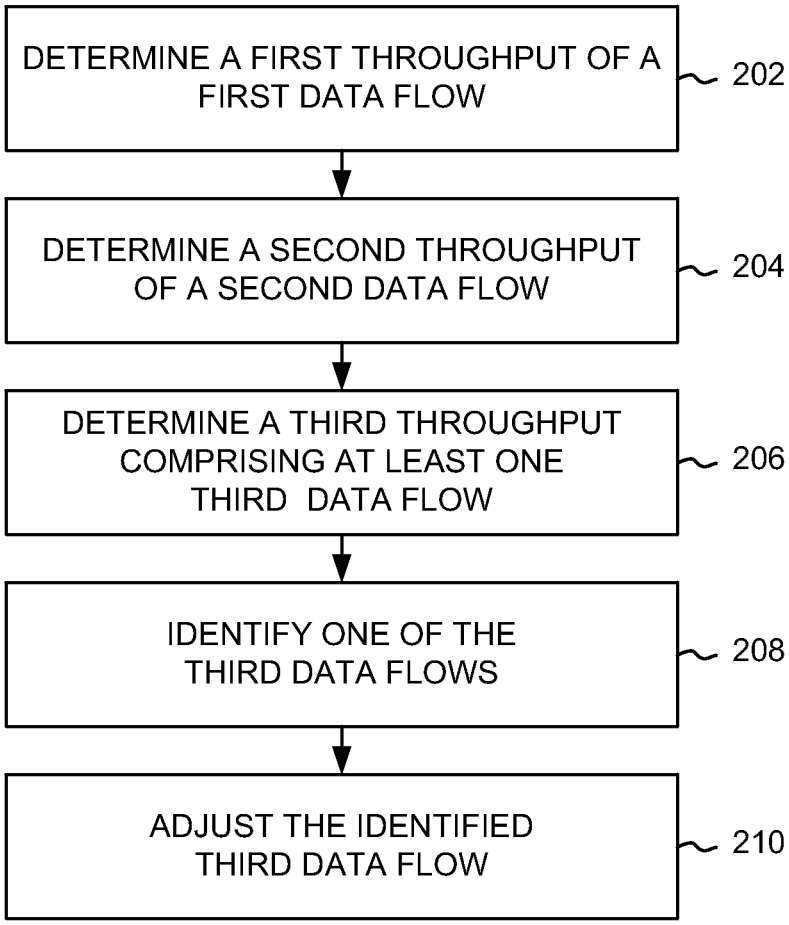
DETERMINE A FIRST THROUGHPUT OF A FIRST DATA FLOW
202
DETERMINE A SECOND THROUGHPUT OF A SECOND DATA FLOW
204
DETERMINE A THIRD THROUGHPUT COMPRISING AT LEAST ONE THIRD DATA FLOW
206
IDENTIFY ONE OF THE THIRD DATA FLOWS
208
ADJUST THE IDENTIFIED THIRD DATA FLOW
210

FIG. 2

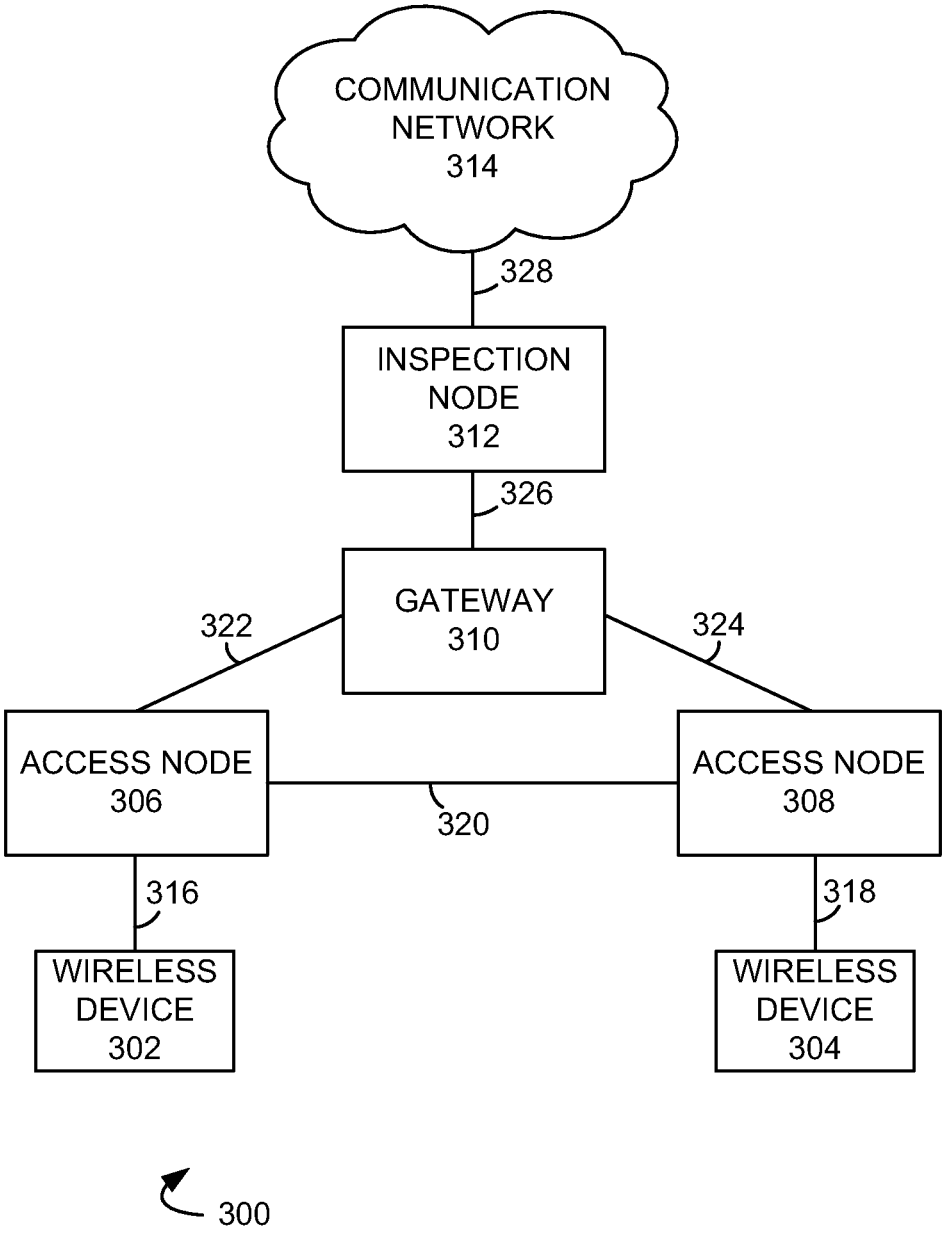
COMMUNICATION NETWORK 314
328
INSPECTION NODE 312
326
GATEWAY 310
322
324
ACCESS NODE 306
320
ACCESS NODE 308
316
318
WIRELESS DEVICE 302
WIRELESS DEVICE 304
300

FIG. 3

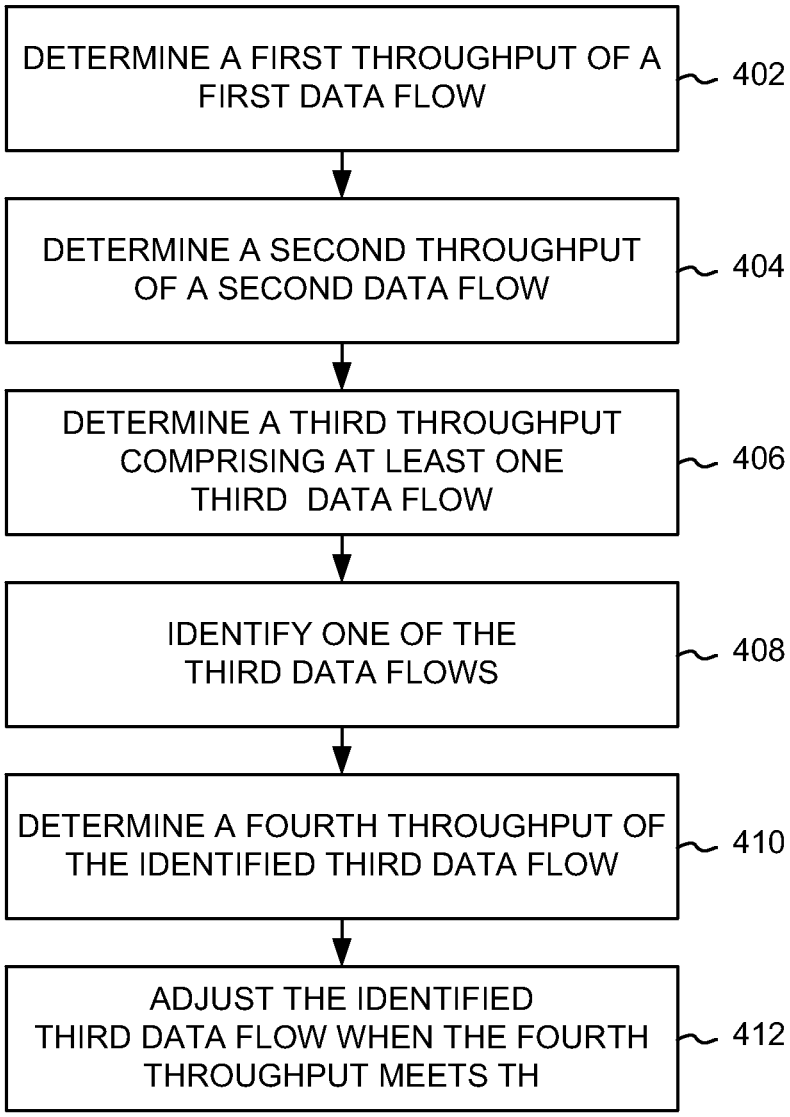
DETERMINE A FIRST THROUGHPUT OF A FIRST DATA FLOW
402
DETERMINE A SECOND THROUGHPUT OF A SECOND DATA FLOW
404
DETERMINE A THIRD THROUGHPUT COMPRISING AT LEAST ONE THIRD DATA FLOW
406
IDENTIFY ONE OF THE THIRD DATA FLOWS
408
DETERMINE A FOURTH THROUGHPUT OF THE IDENTIFIED THIRD DATA FLOW
410
ADJUST THE IDENTIFIED THIRD DATA FLOW WHEN THE FOURTH THROUGHPUT MEETS TH
412

FIG. 4

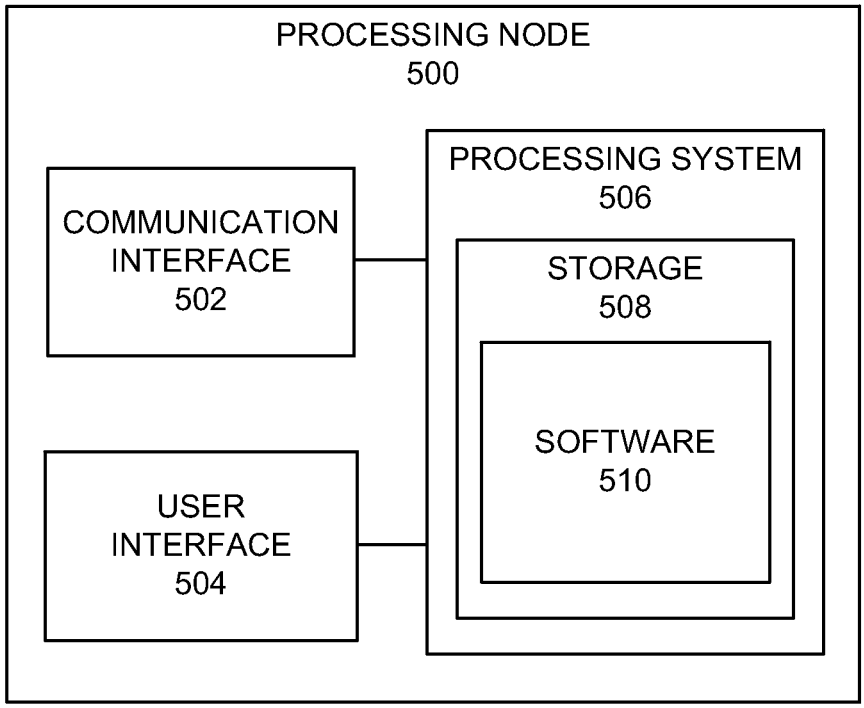
PROCESSING NODE
500
PROCESSING SYSTEM
506
COMMUNICATION
INTERFACE
502
STORAGE
508
SOFTWARE
510
USER
INTERFACE
504

FIG. 5

SYSTEMS AND METHODS OF MANAGING NETWORK COMMUNICATION

TECHNICAL BACKGROUND

Communication network operators employ traffic management techniques to prevent network overload. Operators monitor traffic into and out of a communication network as well as purely within the communication network. Applications which consume large amounts of network resources are of particular concern to network operators, which therefore desire to detect and monitor such network behavior, and where necessary to adjust the usage of network resources by such applications.

OVERVIEW

In an embodiment, a first throughput is determined of a first data flow at a gateway from a first access node and a second throughput is determined of second data flow at an inspection node from the gateway. A third throughput is determined comprising one or more third data flows from the gateway to a second access node based on a difference between the first throughput and the second throughput. One of the third data flows of the third throughput is identified, and when the third throughput meets a throughput threshold the identified third data flow is adjusted.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an exemplary communication system to manage network communication.

FIG. **2** illustrates an exemplary method of managing network communication.

FIG. **3** illustrates another exemplary communication system to manage network communication.

FIG. **4** illustrates another exemplary method of managing network communication.

FIG. **5** illustrates an exemplary processing node.

DETAILED DESCRIPTION

FIG. **1** illustrates an exemplary communication system **100** to manage network communication comprising access nodes **102** and **104**, gateway **106**, inspection node **108**, and communication network **110**. Access nodes **102** and **104** each are a network node capable of providing wireless communications to a wireless device, and can be, for example, a base transceiver station, a radio base station, an eNodeB device, or an enhanced eNodeB device. Access node **102** is in communication with gateway **106** over communication link **114**, and access node **104** is in communication with gateway **106** over communication link **116**. Access nodes **102** and **104** can communicate with each other over communication link **112**.

Gateway **106** is a network element in communication access nodes **102** and **104** and with inspection node **108**. Gateway **106** can comprise a processor and associated circuitry to execute or direct the execution of computer-readable instructions to manage network communication. Gateway **106** can retrieve and execute software from storage, which can include a disk drive, flash drive, memory circuitry, or some other memory device, and which can be local or remotely accessible. The software comprises computer programs, firmware, or some other form of machine-readable instructions, and may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software, including combinations thereof. Gateway **106** can, among other things, receive a data flow from access node **102** or **104**, and can also provide a data flow to access node **102** or **104**, as well as to inspection node **108**. Gateway **106** can receive instructions and other input at a user interface. Examples of gateway **106** can include a standalone computing device, a computer system, or a network component.

Inspection node **108** can communicate with gateway **106** over communication link **118** and with communication network **110** over communication link **120**. Inspection node **108** is a network element which can comprise a processor and associated circuitry to execute or direct the execution of computer-readable instructions. Inspection node **108** can retrieve and execute software from storage, which can include a disk drive, flash drive, memory circuitry, or some other memory device, and which can be local or remotely accessible. The software comprises computer programs, firmware, or some other form of machine-readable instructions, and may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software, including combinations thereof. Inspection node **108** can, among other things, perform deep packet inspection of packets sent from gateway **106**. Deep packet inspection generally involves an inspection of packets beyond Open Systems Interconnection (OSI) layer **3** and can include an inspection of the data portion of a packet (and possibly also the header of a packet). Inspection node **108** can be for example, a standalone computing device or network element, or the functionality of inspection node **108** can be included in another network element, such as a mobility management entity (MME), a gateway, a proxy node, or another network element.

Communication network **110** can be a wired and/or wireless communication network, and can comprise processing nodes, routers, gateways, and physical and/or wireless data links for carrying data among various network elements, including combinations thereof, and can include a local area network, a wide area network, and an internetwork (including the Internet). Communication network **110** may also comprise base stations, wireless communication nodes, telephony switches, internet routers, network gateways, computer systems, communication links, or some other type of communication equipment, and combinations thereof. Wireless network protocols may comprise code division multiple access (CDMA) 1×RTT, Global System for Mobile communications (GSM), Universal Mobile Telecommunications System (UMTS), High-Speed Packet Access (HSPA), Evolution Data Optimized (EV-DO), EV-DO rev. A, Third Generation Partnership Project Long Term Evolution (3GPP LTE), and Worldwide Interoperability for Microwave Access (WiMAX). Wired network protocols that may be utilized by communication network **110** comprise Ethernet, Fast Ethernet, Gigabit Ethernet, Local Talk (such as Carrier Sense Multiple Access with Collision Avoidance), Token Ring, Fiber Distributed Data Interface (FDDI), and Asynchronous Transfer Mode (ATM).

Communication links **112**, **114**, **116**, **118** and **120** can be wired or wireless communication links. Wired communication links can be, for example, twisted pair cable, coaxial cable or fiber optic cable, or combinations thereof. Wireless communication links can be a radio frequency, microwave, infrared, or other similar signal, and can use a suitable communication protocol, for example, Global System for Mobile telecommunications (GSM), Code Division Multiple Access (CDMA), Worldwide Interoperability for Microwave Access (WiMAX), or Long Term Evolution (LTE), or combinations thereof. Other wireless protocols can also be used.

Other network elements may be present in the communication system **100** to facilitate wireless communication but

are omitted for clarity, such as base stations, base station controllers, gateways, mobile switching centers, dispatch application processors, and location registers such as a home location register or visitor location register. Furthermore, other network elements may be present to facilitate communication between access nodes **102** and **104**, gateway **106**, inspection node **108**, and communication network **110** which are omitted for clarity, including additional processing nodes, routers, gateways, and physical and/or wireless data links for carrying data among the various network elements.

Inspection node **108** can examine and measure data flows to and from gateway **106**, but cannot measure other data flows of gateway **106**, such as, for example, data flows between access node **102** and access node **104**. However, such intra-access node traffic typically passes through gateway **106**. In operation, a throughput of a data flow from access node **102** to gateway **106** is determined, and a throughput of a data flow from gateway **106** to inspection node **108** is also determined. Based on a difference between the throughput from access node **102** to gateway **106**, and the throughput from gateway **106** to inspection node **108**, a throughput between gateway **106** and access node **104** is determined comprising one or more data flows. The one or more data flows between gateway **106** and access node **104** can be identified and monitored, and when the throughput between gateway **106** and access node **104** meets a throughput threshold, and identified third data flow can be adjusted.

FIG. **2** illustrates an exemplary method of managing network communication. In operation **202**, a first throughput of a first data flow is determined. For example, a first data flow can be received at gateway **106** from access node **102**, and a first throughput of the first data flow from access node **102** can be determined.

In operation **204**, a second throughput of a second data flow is determined. For example, a second data flow can be received at inspection node **108** from gateway **106**, and a second throughput of the second data flow from gateway **106** can be determined.

Based on a difference between the first throughput and the second throughput, a third throughput comprising one or more third data flows from the gateway to the second access node can be determined (operation **206**). For example, a third throughput from gateway **106** to access node **104** can be determined. The third throughput can comprise one or more third data flows, where the throughput of each third data flow contributes to the third throughput. The third data flows can be, for example, data flows comprising information sent to a wireless device in communication with access node **104**. In an embodiment, at least one of the third data flows can comprise information sent by a wireless device in communication with access node **102**.

One of the third data flows of the third throughput is identified (operation **208**), and when the third throughput meets a throughput threshold the identified third data flow is adjusted (operation **210**). In an embodiment, the third data flow can comprise information sent by a wireless device in communication with access node **102** to a wireless device in communication with access node **104**. An example of a type of data traffic sent from one wireless device to another wireless device is peer-to-peer communication. Communication network operators typically attempt to monitor traffic into, out of, and within a communication network. Also, network operators typically desire to detect and monitor applications which consume network resources. Applications which use large amounts of network resources are of particular concern to network operators. For example, come peer-to-peer applications exhibit "greedy" behavior, consuming a large portion of available network resources in order to send information from one peer to another. Network operators therefore desire to detect and monitor such network behavior, and where necessary to adjust the usage of network resources by such applications.

In an embodiment, access nodes **102** and **104** and gateway **106** can be considered to be network elements of a first communication network, and communication network **110** can be considered a second communication network. In an embodiment, the first throughput can be a measurement of traffic within a first communication network. In an embodiment, the second throughput can be a measurement of traffic which is being sent from a first communication network to a second communication network, for example from gateway **106** to communication network **110**. In an embodiment, the third throughput can be a measurement of traffic within the first communication network, less the second throughput, i.e., traffic being sent from the first communication network to the second communication network.

FIG. **3** illustrates another exemplary communication system **300** to manage network communication comprising wireless devices **302** and **304**, access nodes **306** and **308**, gateway **310**, inspection node **312**, and communication network **314**. Examples of wireless devices **302** and **304** can include a cell phone, a smart phone, a computing platform such as a laptop, palmtop, or tablet, a personal digital assistant, or an internet access device, including combinations thereof. Wireless device **302** is in communication with access node **306** over communication link **316**, and wireless device **304** is in communication with access node **308** over communication link **318**.

Each of access nodes **306** and **308** is a network node capable of providing wireless communications to a wireless device, and can be, for example, a base transceiver station, a radio base station, an eNodeB device, or an enhanced eNodeB device. Access node **306** is in communication with gateway **310** over communication link **322**, and access node **308** is in communication with gateway **310** over communication link **324**. Access nodes **306** and **308** can communicate with each other over communication link **320**.

Gateway **310** is a network element in communication access nodes **306** and **308** and with inspection node **312**. Gateway **310** can comprise a processor and associated circuitry to execute or direct the execution of computer-readable instructions. Gateway **310** can retrieve and execute software from storage, which can include a disk drive, flash drive, memory circuitry, or some other memory device, and which can be local or remotely accessible. The software comprises computer programs, firmware, or some other form of machine-readable instructions, and may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software, including combinations thereof. Gateway **310** can, among other things, receive a data flow from access node **306** or **308**, and can also provide a data flow to access node **306**, access node **308**, or to inspection node **312**. Gateway **310** can receive instructions and other input at a user interface. Examples of gateway **310** can include a standalone computing device, a computer system, or a network component.

Inspection node **312** can communicate with gateway **310** over communication link **326** and with communication network **314** over communication link **328**. Inspection node **312** is a network element which can comprise a processor and associated circuitry to execute or direct the execution of computer-readable instructions. Inspection node **312** can retrieve and execute software from storage, which can include a disk drive, flash drive, memory circuitry, or some other memory

device, and which can be local or remotely accessible. The software comprises computer programs, firmware, or some other form of machine-readable instructions, and may include an operating system, utilities, drivers, network interfaces, applications, or some other type of software, including combinations thereof. Inspection node **312** can, among other things, perform deep packet inspection of packets sent from gateway **310**. Deep packet inspection generally involves an inspection of packets beyond Open Systems Interconnection (OSI) layer **3** including an inspection of the data portion of a packet (and possibly also the header of a packet). Inspection node **312** can be for example, a standalone computing device or network element, or the functionality of inspection node **312** can be included in another network element, such as a mobility management entity (MME), a gateway, a proxy node, or another network element.

Communication network **314** can be a wired and/or wireless communication network, and can comprise processing nodes, routers, gateways, and physical and/or wireless data links for carrying data among various network elements, including combinations thereof, and can include a local area network, a wide area network, and an internetwork (including the Internet). Communication network **314** may also comprise base stations, wireless communication nodes, telephony switches, internet routers, network gateways, computer systems, communication links, or some other type of communication equipment, and combinations thereof. Wireless network protocols may comprise code division multiple access (CDMA) 1×RTT, Global System for Mobile communications (GSM), Universal Mobile Telecommunications System (UMTS), High-Speed Packet Access (HSPA), Evolution Data Optimized (EV-DO), EV-DO rev. A, Third Generation Partnership Project Long Term Evolution (3GPP LTE), and Worldwide Interoperability for Microwave Access (WiMAX). Wired network protocols that may be utilized by communication network **314** comprise Ethernet, Fast Ethernet, Gigabit Ethernet, Local Talk (such as Carrier Sense Multiple Access with Collision Avoidance), Token Ring, Fiber Distributed Data Interface (FDDI), and Asynchronous Transfer Mode (ATM).

Communication links **316**, **318**, **320**, **322**, **324**, **326** and **328** can be wired or wireless communication links. Wired communication links can be, for example, twisted pair cable, coaxial cable or fiber optic cable, or combinations thereof. Wireless communication links can be a radio frequency, microwave, infrared, or other similar signal, and can use a suitable communication protocol, for example, Global System for Mobile telecommunications (GSM), Code Division Multiple Access (CDMA), Worldwide Interoperability for Microwave Access (WiMAX), or Long Term Evolution (LTE), or combinations thereof. Other wireless protocols can also be used.

Other network elements may be present in the communication system **300** to facilitate wireless communication but are omitted for clarity, such as base stations, base station controllers, gateways, mobile switching centers, dispatch application processors, and location registers such as a home location register or visitor location register. Furthermore, other network elements may be present to facilitate communication between access nodes **306** and **308**, gateway **310**, inspection node **312**, and communication network **314** which are omitted for clarity, including additional processing nodes, routers, gateways, and physical and/or wireless data links for carrying data among the various network elements.

FIG. **4** illustrates an exemplary method of managing network communication. In operation **402**, a first throughput of a first data flow is determined. For example, a first data flow can be received at gateway **310** from access node **306**, and a first throughput of the first data flow from access node **306** can be determined.

In an embodiment, the first throughput and the second throughput can be associated with at least one of an uplink portion and/or a downlink portion of a wireless communication link, such as communication link **316** and/or communication link **318**. In an embodiment, the first throughput can be associated with an uplink portion and/or a downlink portion of communication link **316**. In an embodiment, the third throughput can be associated with an uplink portion and/or a downlink portion of communication link **318**.

The determination of a throughput can be based on one or more factors. For example, in an embodiment, the second throughput can be determined based on at least one of a modulation and coding scheme assigned to the second data flow, an uplink throughput, a downlink throughput, a congestion criteria, a communication link load, and a number of wireless devices using a communication link.

In operation **404**, a second throughput of a second data flow is determined. For example, a second data flow can be received at inspection node **312** from gateway **310**, and a second throughput of the second data flow from gateway **310** can be determined.

Based on a difference between the first throughput and the second throughput, a third throughput comprising one or more third data flows from the gateway to the second access node can be determined (operation **406**). For example, a third throughput from gateway **310** to access node **308** can be determined. The third throughput can comprise one or more third data flows, where the throughput of each third data flow contributes to the third throughput. A third data flow can comprise, for example, information sent to wireless device **304** in communication with access node **308**. In an embodiment, a third data flow can comprise, for example, information sent to wireless device **304** from wireless device **302**. One example of a third data flow can be a peer-to-peer data flow.

One or more third data flows of the third throughput are identified (operation **408**), and a fourth throughput of the identified third data flow is determined (operation **410**). For example, the third throughput can comprise a plurality of data flows, and each of the plurality of data flows can each comprise a fourth throughput, such that the third throughput comprises a plurality of fourth throughputs. In an embodiment, the third data flows can be examined at a greater level of detail to identify a contribution of each third data flow to the third throughput.

A third data flow can be identified based on, for example, network location information of its source and its destination, such as an internet protocol (IP) address associated with the source and/or destination, or a port associated with the source and/or destination. In an embodiment, at least one of the third data flows can be identified based on additional information, for example, based on a network source location, a network destination location, and the difference of the first throughput and the second throughput. In an embodiment, at least one of the third data flows can be identified based on a network source location, a network destination location, the difference of the first throughput and the second throughput, and whether a resource utilization meets a utilization threshold.

The resource utilization can be, for example, a utilization of network resources at an access node. For example, the resource utilization can be based on at least one of a modulation and coding scheme (MCS), and IP address or port associated with the data flow, the fourth throughput of the identified third data flow, a consumption of radio frequency

resources of a communication link by the third data flow (i.e., an RF load), and a total number of devices using the network resources. The access node can be, for example, an access node serving a wireless device to which information is being sent (for example, access node **308** and wireless device **304**). In an embodiment, the utilization can also be determined at a sub-unit of an access node, such as a sector, and the resource utilization is a utilization of resources at a sector served by a destination access node.

In operation **412**, when the fourth throughput meets a throughput threshold the identified third data flow is adjusted. In an embodiment, the throughputs of each of the identified third data flows (i.e., the fourth throughputs) can be monitored, and it can be determined when one of the fourth throughputs meets a threshold. The threshold can comprise, for example, a data rate. A data rate can also be considered together with a type of data traffic and/or an application type to form a threshold. A threshold can also comprise an amount of data, either absolute or over a period of time. A priority level of the data traffic can also be considered. Combinations of the foregoing are also possible. For example, data traffic associated with a delay-sensitive application, such as voice data (e.g., from a VoIP application or other similar application) can be associated with a first data rate threshold, and data traffic associated win a non-delay-sensitive application can be associated with a second data rate threshold lower than the first data rate threshold.

When the fourth throughput meets the threshold, the data flow can be adjusted. For example, the data rate of the identified third data flow can be reduced. The third data flow can also be limited to a total amount of data, such as a data cap or maximum amount of data. Further, the third data flow can be limited to a data rate threshold, for example, in the case of a third data flow which is bursty, jittery, or intermittent. As another example, the third data flow can be limited to a period of time, beyond which the third data flow is reduced or stopped. In an embodiment, the third data flow is adjusted to bring a total amount of traffic between access nodes **306** and **308** down to a traffic threshold while maintaining a communication session with wireless device **304**. For example, the third data flow can be adjusted to reduce the total amount of traffic between access nodes **306** and **308** down to a traffic threshold while avoiding a disconnection of a communication session with wireless device **304**.

FIG. **5** illustrates an exemplary processing node **500** in a communication system. Processing node **500** comprises communication interface **502**, user interface **504**, and processing system **506** in communication with communication interface **502** and user interface **504**. Processing node **500** is capable of managing network communication. Processing system **506** includes storage **508**, which can comprise a disk drive, flash drive, memory circuitry, or other memory device. Storage **508** can store software **510** which is used in the operation of the processing node **500**. Storage **508** may include a disk drive, flash drive, data storage circuitry, or some other memory apparatus. Software **510** may include computer programs, firmware, or some other form of machine-readable instructions, including an operating system, utilities, drivers, network interfaces, applications, or some other type of software. Processing system **506** may include a microprocessor and other circuitry to retrieve and execute software **510** from storage **508**. Processing node **500** may further include other components such as a power management unit, a control interface unit, etc., which are omitted for clarity. Communication interface **502** permits processing node **500** to communicate with other network elements. User interface **504** permits the configuration and control of the operation of processing node **500**. Examples of processing node **500** include gateway **310** and inspection node **312**. Processing node can also be an adjunct or component of a network element, such as an element of gateway **310** and inspection node **312**. Processing node **500** can also be another network element in a communication system.

The exemplary systems and methods described herein can be performed under the control of a processing system executing computer-readable codes embodied on a computer-readable recording medium or communication signals transmitted through a transitory medium. The computer-readable recording medium is any data storage device that can store data readable by a processing system, and includes both volatile and nonvolatile media, removable and non-removable media, and contemplates media readable by a database, a computer, and various other network devices.

Examples of the computer-readable recording medium include, but are not limited to, read-only memory (ROM), random-access memory (RAM), erasable electrically programmable ROM (EEPROM), flash memory or other memory technology, holographic media or other optical disc storage, magnetic storage including magnetic tape and magnetic disk, and solid state storage devices. The computer-readable recording medium can also be distributed over network-coupled computer systems so that the computer-readable code is stored and executed in a distributed fashion. The communication signals transmitted through a transitory medium may include, for example, modulated signals transmitted through wired or wireless transmission paths.

The above description and associated figures teach the best mode of the invention. The following claims specify the scope of the invention. Note that some aspects of the best mode may not fall within the scope of the invention as specified by the claims. Those skilled in the art will appreciate that the features described above can be combined in various ways to form multiple variations of the invention. As a result, the invention is not limited to the specific embodiments described above, but only by the following claims and their equivalents.

What is claimed is:

1. A method of managing intra-access node traffic, the method comprising:

receiving a first data flow at a gateway node from a first access node and, based on the received first data flow, determining an associated first throughput;

inspecting a second data flow received from the gateway node at an inspection node and, based on the inspection, determining a second throughput associated with the second data flow;

identifying, at the gateway node, one or more peer-to-peer data flows sent from the gateway node to at least a second access node, wherein each of the one or more peer-to-peer data flows is identified based on:

a calculated difference of the first throughput and the second throughput; and,

a calculated resource utilization that is based at least on a modulation and coding scheme (MCS) assigned to the one or more of the peer-to-peer data flows;

determining that a third throughput associated with each of the one or more peer-to-peer data flows meets a threshold; and,

adjusting at least one of the one or more peer-to-peer data flows exceeding a predefined usage threshold to meet a total traffic threshold.

2. The method of claim **1**, wherein the first throughput and the second throughput are associated with at least one of an uplink portion of a communication link and a downlink portion of the communication link.

3. The method of claim 1, wherein the second throughput is determined based on at least one of a modulation and coding scheme (MCS) assigned to the second data flow, an uplink throughput, a downlink throughput, a congestion criteria, a communication link load, and a number of wireless devices using a communication link.

4. The method of claim 1, further comprising:

identifying one of the one or more peer-to-peer data flows based on a network source location, a network destination location, and the difference of the first throughput and the second throughput.

5. The method of claim 1, further comprising:

identifying one of the one or more peer-to-peer data flows based on a network source location and a network destination location.

6. The method of claim 1, wherein the resource utilization associated with each of the one or more peer-to-peer data flows is a determined utilization of resources at a sector served by a destination access code.

7. The method of claim 1, wherein adjusting the one or more peer-to-peer data flows further comprises at least one of adjusting a data rate of the one or more of the peer-to-peer identified third data flows, limiting a total amount of data, limiting a data rate to a data rate threshold, and limiting the third data flow to a time period.

8. A system for managing intra-access node traffic, the system comprising:

a processing node configured to:

determine a first throughput associated with a first data flow received at a gateway node from a first access node;

inspect a second data flow received at an inspection node from the gateway node and, based on the inspection, determine a second throughput associated with the second data flow;

identify one or more peer-to-peer data flows sent from the gateway node to at least a second access node, wherein each of the one or more peer-to-peer data flows is identified based on:

a calculated difference between the first throughput and the second throughput; and,

a calculated resource utilization that is determined based at least on a modulation and coding scheme (MCS) assigned to one or more of the peer-to-peer data flows;

determine a third throughput associated with each of the one or more peer-to-peer data flows; and,

adjust at least one of the one or more peer-to-peer data flows exceeding a predefined usage threshold to meet a total traffic threshold.

9. The system of claim 8, wherein the first throughput and the second throughput are associated with at least one of an uplink portion of a communication link and a downlink portion of the communication link.

10. The system of claim 8, wherein the second throughput is determined based on at least one of a modulation and coding scheme (MCS) assigned to the second data flow, an uplink throughput, a downlink throughput, a congestion criteria, a communication link load, and a number of wireless devices using a communication link.

11. The system of claim 8, wherein the processing node is further configured to:

identify one of the one or more peer-to-peer data flows based on a network source location and a network destination location.

12. The method of claim 8, wherein the resource utilization is a utilization of resources at a sector served by a destination access node.

13. The system of claim 8, wherein the processing node is further configured to adjust the at least one of the one or more peer-to-peer data flows by at least one of adjusting a data rate of the at least one peer-to-peer data flow, limiting a total amount of data, limiting a data rate to a data rate threshold, and limiting the at least one peer-to-peer data flow to a time period.

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